

- Low energy beams : from 95MeV/A for light ions to 20 MeV/A for U

⇒ Use of low pressure gaseous detectors:

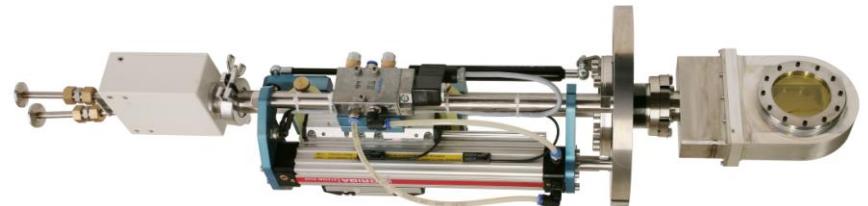
- Trackers: CATs, SED, MWPPAC
- Drift Chambers: VAMOS DC, SHARAQ (RIKEN)
- Ionization chambers: VAMOS, INDRA



-Active targets: the gas of the detector is also the target for nuclear reactions

- MAYA
- ACTAR-TPC

- Beam Profile Monitor using MW chambers at normal or low pressure

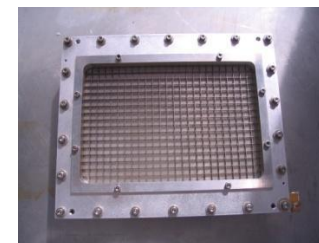
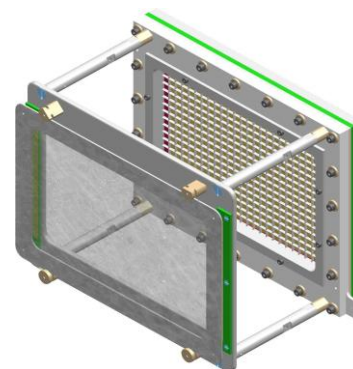


- Beam tracking mandatory to reconstruct reaction kinematics (resolution of 1.5 mm and 250 ns, high counting rates 10^5 pps/cm²) either for beams of large emittance or at the focal plane of spectrometers
- Low energy and angular straggling \Rightarrow thin window detectors at very low pressure (10 mbar of pure isobutane), generally wire chambers
- Detectors in the beam at high energy (> 10 MeV/n, 500 $\mu\text{g}/\text{cm}^2$) or outside the beam for low energy with Secondary Electrons Detectors (2 to 10 MeV/n, emissive foil thickness < 150 $\mu\text{g}/\text{cm}^2$)
- In the forthcoming years SPIRAL2 (S³ or NFS) will need detectors for heavy nuclei or fission fragments at low energy ($< 6\text{-}7$ MeV/n)
- An R&D program has been initiated 4 years ago (collaboration between IRFU and in2p3) to cover the need in this type of detection for the next 10 years
- Different topics of work: detectors at low pressure with wire chambers or MPPGD (micromegas), secondary electron detection, use of new electronics like GET
- Some of the recent developments:

S3 focal plane

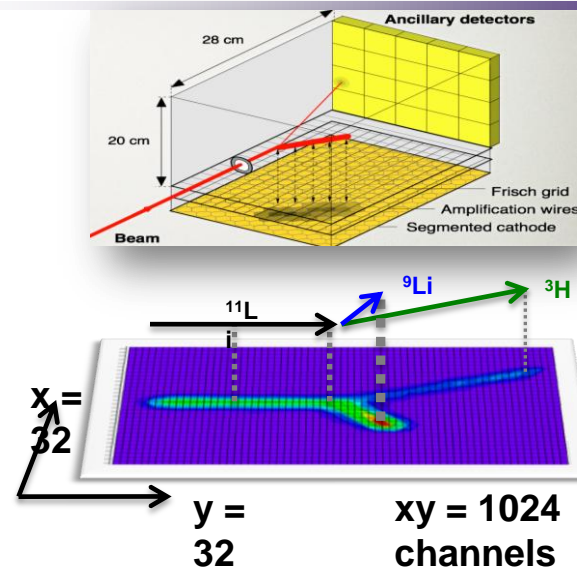
2 SED prototypes: wire chambers and micromegas

VAMOS focal plane
1 m large detection
set-up with
1 MWPPAC, 2 DC,
3 CHIO, 40 Si



Active targets in nuclear physics

- Based on TPC concept from particle physics
- The Gas is also the target for nuclear reaction study
- CENBG TPC (2p decay), MAYA (GANIL)...
- Astrophysics, Nuclear structure:
 - Nucleon transfert on light or FF nuclei
 - Resonant reactions
 - Exotic decays...
- Advantages versus classical solid targets:
 - Trajectory reconstruction
 - efficiency (gas thickness...)
 - Low energy threshold
 - Direct study on beam energy dependance



In the framework of SPIRAL2, several Letters Of Intent submitted, need for an improved detection system for the next years:

- Counting rates
- Multi-particules
- Low energy threshold, spatial resolution
- Reconstruction efficiency
- New electronics (16k channels with GET)
- Energy dynamics

⇒ Detector R&D program using MPGD, working demonstrator in 2013

